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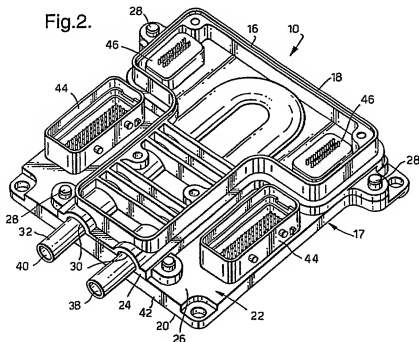
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(56) Documents Cited  
GB 2313960 A EP 0238915 A1 EP 0014249 A1  
US 4718163 A US 4155402 A

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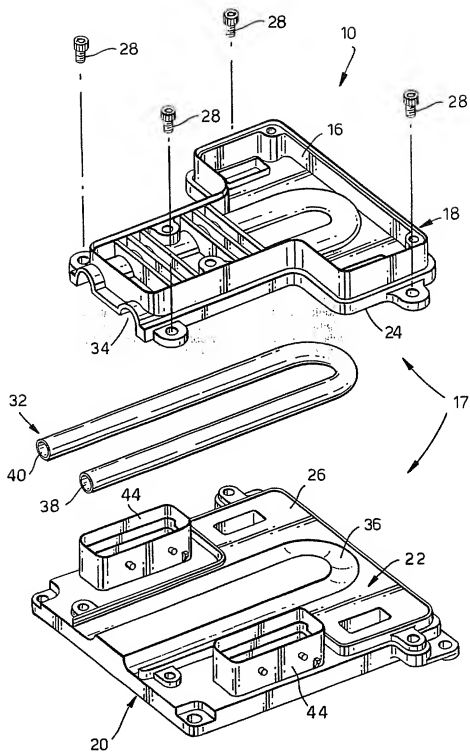
(54) Abstract Title  
Cooling motor vehicle control modules.

(57) A control module 10 for a motor vehicle comprises a housing 17 having a first side 16 and a second side 20. A first electrical circuit board (12, Fig 3) is mounted on the first side of the housing and a second electrical circuit board (14, Fig 4) is mounted on the second side of the housing. A channel 30 is formed in the housing between the first and second sides and a fluid pipe 32 extends through the channel, the fluid pipe having an inlet 38 and an outlet 40. Fuel is passed through the fluid pipe for dissipating heat from the circuit boards. The arrangement allows integration of circuit boards having different heat dissipation requirements in a single module.



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Fig.1.



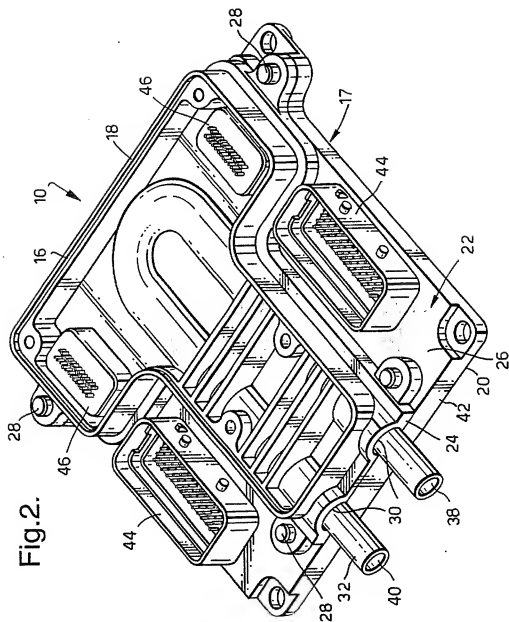
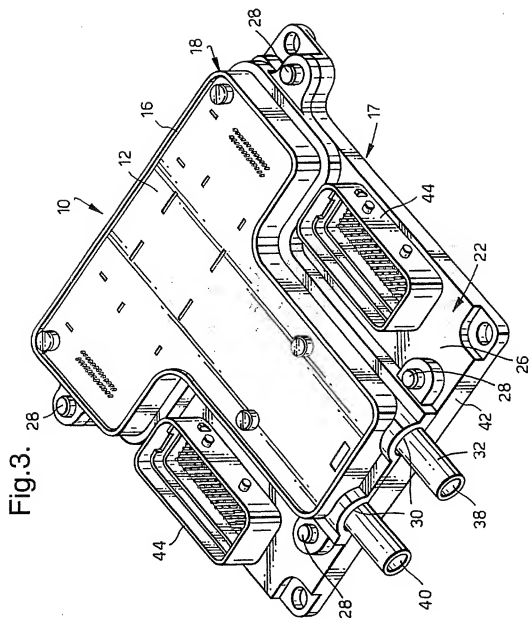
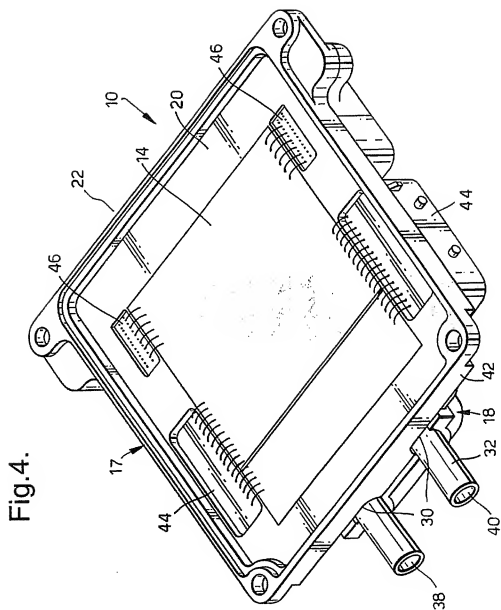
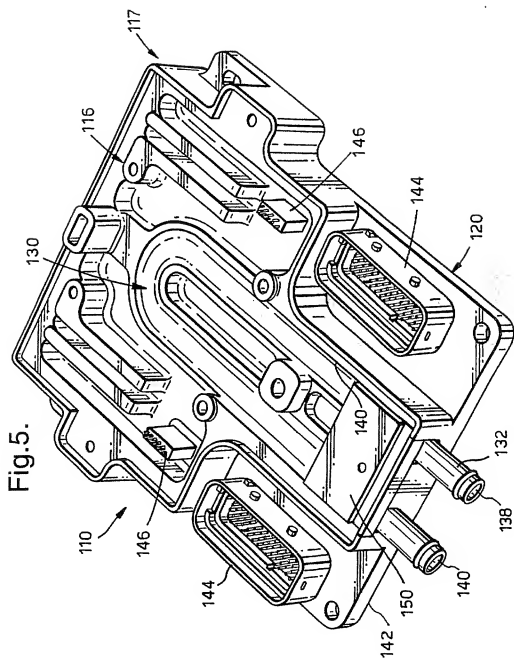


Fig.2.







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**MOTOR VEHICLE CONTROL MODULE**Technical Field

The present invention relates to a control module for  
5 installation in the engine compartment of a motor vehicle, and in particular to  
a control module requiring liquid cooling.

Background of the Invention

An engine control module, in general, comprises two elements,  
10 the electronic control module and a high voltage driver module. Although  
these two modules work in unison, the modules are usually formed separately,  
and installed separately, within the engine compartment of a motor vehicle.  
The reason for this approach is because both modules have different heat  
dissipation requirements, and combining both would considerably increase  
15 packaging size in order to provide the necessary heat dissipation.

Summary of the Invention

The object of the present invention is to overcome the above  
mentioned problem.

20 A control module in accordance with the present invention for a  
motor vehicle comprises a housing having a first side and a second side; a first  
electrical circuit board mounted on the first side of the housing; a second  
electrical circuit board mounted on the second side of the housing; a channel  
formed in the housing between the first and second sides; and a fluid pipe  
25 positioned in and extending through the channel, the fluid pipe having an inlet  
and an outlet positioned outside the housing.

In the present invention, fluid (for example, fuel for the vehicle  
engine) is passed through the fluid pipe for providing cooling for the circuit  
boards. The housing acts as a cold plate, and heat is dissipated to the fluid in  
30 the pipe. This arrangement allows circuit boards having different heat

dissipation requirements to be integrally mounted in a single module without significantly increasing overall packaging size.

#### Brief Description of the Drawings

5           The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

          Figure 1 is an exploded view of the housing of a control module in accordance with a first embodiment of the present invention;

          Figure 2 is a perspective view of the assembled housing of  
10   Figure 1;

          Figure 3 is a perspective view from one side of the assembled control module having the housing of Figures 1 and 2;

          Figure 4 is a perspective view from the other side of the assembled control module; and

15           Figure 5 is a perspective view of a housing of a control module in accordance with a second embodiment of the present invention.

#### Description of the Preferred Embodiment

          Referring to Figures 1 to 4 of the drawings, the first  
20   embodiment of control module 10 of the present invention is for installation in the engine compartment (not shown) of a motor vehicle. The control module 10 comprises first and second electrical boards 12, 14 - for example, in the case of an engine control module, the first board can contain the high voltage driver circuitry components, and the second board can contain the electronic  
25   control components. The control module 10 includes a housing 17 which comprises a first housing member 18 and a second housing member 22. The first board 12 is mounted in any suitable manner (for example, screws, adhesive, etc.) on a first side 16 of the first housing member 18. The second board 14 is mounted in any similar suitable manner on a first side 20 of the  
30   second housing member 22. The first side 16 of the first housing member 18 defines a first side of the housing 17, and the first side 20 of the second



housing member 22 defines a second side of the housing 17. The second sides 24, 26 of the first and second housing members 18, 22, respectively, are preferably substantially planar. The first and second housing members 18, 22 are secured together by screws 28, or any other suitable fastening means, with the second sides 24, 26 thereof in contact with one another, to define the housing 17.

The second sides 24, 26 of the housing members 18, 22 define, when secured together, a channel 30 which has an axis lying in a plane which extends substantially parallel to the planar direction of the second sides. A fluid pipe 32 is positioned in, and extends through, the channel 30 with an inlet 38 and an outlet 40 positioned outside of the housing 17. The fluid pipe 32 is therefore positioned between, and preferably in contact with, the first and second housing members 18, 22 when the housing members are secured together. The fluid pipe 32 may additionally be secured in place by a thermally conductive adhesive. The channel 30 is preferably defined by semi-circular aligned grooves 34, 36 formed in the second sides 24, 26, respectively, of the first and second housing members 18, 22, respectively. The channel 30, and hence the fluid pipe 32, are preferably U-shaped such that the inlet 38 and the outlet 40 are positioned adjacent one another at one end of the housing 17.

One or more electrical connectors 44 may be mounted on the second housing member 22 for providing an electrical connection between the second board 14 and a wiring harness (not shown) in the motor vehicle. One or more electrical connecting devices 46 may be mounted in the first and second housing members 18, 22 for providing electrical connections between the first and second boards 12, 14.

Referring to Figure 5, the control module 100 in accordance with the second embodiment of the present invention is similar to the control module 10 of Figures 1 to 4, and like parts have the same reference numeral prefixed by 100. In the second embodiment, the housing 117 is formed in one piece with the channel 130 being formed as a U-shaped groove 148 in the first

side 116 of the housing. The fluid pipe 132 is positioned in the channel 130 and retained in place by thermal adhesive and a thermal interface plate 150. The first board 112 is secured to the first side 116 of the housing 117, and the second board (not shown) is secured to the second side 120 of the housing in substantially the same manner as described above for the first embodiment.

The present invention allows the integral assembly of a control module having circuit boards which provide different functions, and hence have different heat dissipation requirements, without the need for increased packaging size. The fluid pipe is connected to the engine cooling system or, more preferably, to the engine fuel system for heat dissipation from the control module. The fluid pipe is isolated from the electrical components of the control module. The housing acts as a cold plate for dissipating heat from the circuit boards to the fluid passing through the fluid pipe.

The present invention has particular application for integrating the high voltage driver circuit and the control circuit for a diesel engine in a single module, with the diesel fuel for the engine passing through the fluid pipe on route to the engine.

Claims

1. A control module for a motor vehicle comprising a housing having a first side and a second side; a first electrical circuit board mounted on the first side of the housing; a second electrical circuit board mounted on the second side of the housing; a channel formed in the housing between the  
5 first and second sides; and a fluid pipe positioned in and extending through the channel, the fluid pipe having an inlet and an outlet positioned outside the housing.
2. A control module as claimed in Claim 1, wherein the housing comprises a first housing member having a first side defining the first side of the housing and a second side; and a second housing member having a first side defining the second side of the housing and a second side; the first  
5 and second housing members being secured together with the second sides of the housing members in contact with one another; the channel being defined between the second sides of the housing members.
3. A control module as claimed in Claim 2, wherein each of the second sides of the first and second housing members are substantially planar.
4. A control module as claimed in Claim 2 or Claim 3, wherein the first and second housing members are secured together by screws.
5. A control module as claimed in any one of Claims 2 to 4, wherein the channel is defined by a semi-circular groove in the second side of the first housing member and a semi-circular groove in the second side of the second housing member, the grooves being aligned.
6. A control module as claimed in any one of Claims 1 to 5, wherein the fluid pipe contacts the housing inside the channel.

7. A control module as claimed in Claim 6, wherein the fluid pipe is held in the channel by a thermally conductive adhesive.

8. A control module as claimed in any one of Claims 1 to 7, wherein the channel and the fluid pipe are substantially U-shaped.

9. A control module as claimed in any one of Claims 1 to 8, further comprising an electrical connecting device mounted in the housing and electrically connecting the first and second electrical circuit boards.

10. A control module substantially as herein described with reference to, and as shown in, the accompanying drawings.



Application No: GB 9916269.5  
Claims searched: All

Examiner: COLIN STONE  
Date of search: 1 November 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H1R(RBK)

Int Cl (Ed.6): H05K 1/02;H05K 7/20

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2313960 A GEC-MARCONI	
Y	EP 0238915 A1 CONTRAVES	1
Y	EP 0014249 A1 SIEMENS (See Fig.3)	1
Y	US 4718163 THOMSON-CSF	1
Y	US 4155402 SPERRY RAND	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.